

We claim:

1. A composite comprising a body of glass having embedded therein a plurality of heterologous nanoparticles, wherein at least certain of said nanoparticles have a diameter of up to about 500 nm and are characterized by the property of altering the polarization of reflected or scattered electromagnetic radiation.

2. The composite of claim 1, said nanoparticles having a diameter of up to about 300 nm.

3. The composite of claim 1, there being from 10^8 - 10^9 nanoparticles per mm^2 of a surface of said body.

4. The composite of claim 1, said nanoparticles being present at a level of from about 10^7 - 10^9 nanoparticles per mm^2 of said body surface.

5. The composite of claim 1, there being from 10^3 - 3×10^{13} nanoparticles per mm^3 of a surface layer of said body.

6. The composite of claim 5, there being from 3×10^{10} - 3×10^{13} nanoparticles per mm^3 of said surface layer of said body

7. The composite of claim 1, at least certain of said nanoparticles being yttrium-iron-garnet nanocrystals.

8. The composite of claim 1, said nanoparticles being nanocrystals.

9. The composite of claim 8, said nanocrystals being rare earth iron garnet nanocrystals.

10. The composite of claim 9, said rare earth iron garnet nanocrystals having the formula $\text{Fe}_3\text{Y}_{3-x-y}\text{M}_x\text{N}_y\text{O}_{12}$ where M and N are different and are respectively taken from the group consisting of Bi, Gd, In, La, Pr, Nd, Pm, Sm, Eu, Tb, Dy, Ho, Er, Tm, Yb and Ln, and x and y are selected to satisfy the equation $0 \leq x + y \leq 1$.

11. The composite of claim 1, said body being formed of porous glass.

12. The composite of claim 11, said porous glass being thirsty glass.

13. A composite comprising a body of glass having embedded therein a plurality of yttrium-iron-garnet nanoparticles.

14. The composite of claim 13, said nanoparticles having a diameter of up to about 500 nm.

15. The composite of claim 14, said diameter being up to about 300 nm.

16. The composite of claim 13, there being from $100-10^9$ nanoparticles per mm^2 of a surface of said body.

17. The composite of claim 16, said nanoparticles being present at a level of from about 10^7-10^9 nanoparticles per mm^2 of said body surface.

18. The composite of claim 13, there being from $10^3-3 \times 10^{13}$ per mm^3 of a surface layer of said body.

19. The composite of claim 18, there being from $3 \times 10^{10}-3 \times 10^{13}$ nanoparticles per mm^3 of said surface layer of said body.

20. The composite of claim 13, said nanoparticles being nanocrystals.

21. The composite of claim 20, said nanocrystals being yttrium-iron garnet nanocrystals.

22. The composite of claim 21, said yttrium-iron garnet nanocrystals having the formula $\text{Fe}_5\text{Y}_{3-x-y}\text{M}_x\text{N}_y\text{O}_{12}$ where M and N are different and are respectively taken from the group consisting of Bi, Gd, In, La, Pr, Nd, Pm, Sm, Eu, Tb, Dy, Ho, Er, Tm, Yb and Ln, and x and y are selected to satisfy the equation $0 \leq x + y \leq 1$.

23. The composite of claim 13, said glass body being formed of porous glass.

24. The composite of claim 23, said porous glass being thirsty glass.

25. An electrooptical recording medium comprising the composite of claim 1.

5 26. The recording medium of claim 25, said composite mounted on a substrate.

27. A method of forming a composite comprising the steps of:
providing a porous glass body;
10 contacting said body with a dispersion including heterologous nanoparticles,
and causing at least certain of said nanoparticles to locate within pores
of said body; and
fusing said pores to embed said nanoparticles located in said body.

15 28. The method of claim 27, said contacting step comprising the step of forming a colloidal dispersion of said nanoparticles, and soaking said body in said colloidal dispersion.

20 29. The method of claim 27, said fusing step comprising the step of heating said body.

25 30. The method of claim 29, said body being formed of porous glass, said heterologous nanoparticles being amorphous nanoparticles prior to said fusing step, said heating step comprising the step of heating the glass body to a maximum temperature of at least about 650°C for a period of time to effect said fusing and to convert said amorphous nanoparticles into nanocrystals.

30 31. The method of claim 30, said maximum temperature being from 650°C to 900°C with said period of time ranging from 0.5 to 20 hours.

32. The method of claim 31, said maximum temperature being 800°C.

35 33. The method of claim 30, including the step of progressively increasing the temperature of said body to said maximum heating temperature, keeping the temperature for a period of time ranging from 0 to 0.5 hours, followed by cooling of the body to ambient temperature.

34. The method of claim 33, said maximum temperature being from 850°C to 950°C.

5 35. The method of claim 34, said maximum temperature being about 900°C.

10 36. The method of claim 33, including the step of heating said body at a rate of at least about 100°C per hour until said maximum heating temperature is reached.

37. The method of claim 36, said rate being at least about 200°C per hour or faster.

15 38. The method of claim 33, including the step of cooling said body at a rate of at least about 100°C per hour until ambient temperature is reached.

39. The method of claim 38, said rate being at least about 200°C per hour or faster.

20 40. The method of claim 27, said nanoparticles having a diameter of up to about 300 nm.

25 41. The method of claim 27, there being at least about 10^6 - 10^9 nanocrystals per mm^2 of a surface of said body.

42. The method of claim 41, said nanoparticles being present at a level of from about 10^7 - 10^9 nanoparticles per mm^2 of said body surface.

30 43. The method of claim 27, there being at least about 10^3 - 3×10^{13} nanoparticles per mm^3 of surface layer of said body.

35 44. The method of claim 43, said nanoparticles being present at a level of from about 3×10^{10} - 3×10^{13} nanoparticles per mm^3 of said surface layer of said body.

45. The method of claim 27, at least certain of said nanoparticles being yttrium-iron garnet nanoparticles.

46. The method of claim 27, said nanoparticles being nanocrystals.

47. The method of claim 46, said nanocrystals being rare earth iron garnet nanocrystals.

48. The method of claim 47, said rare earth iron garnet nanocrystals having the formula $\text{Fe}_5\text{Y}_{3-x-y}\text{M}_x\text{N}_y\text{O}_{12}$ where M and N are different and are respectively taken from the group consisting of Bi, Gd, In, La, Pr, Nd, Pm, Sm, Eu, Tb, Dy, Ho, Er, Tm, Yb and Ln, and x and y are selected to satisfy the equation $0 \leq x + y \leq 1$.

49. The method of claim 27, said body being formed of porous glass.

50. The method of claim 49, said porous glass being thirsty glass.

51. The method of claim 27, said nanoparticles being formed by the alkoxide method.

52. The method of claim 27, said dispersion comprising kerosene and surfactant mixture, said dispersion formed by agitating said particles in said mixture so as to coat said nanoparticles with said surfactant.

53. A composite comprising a body of porous glass having embedded within the pores thereof heterologous nanoparticles, wherein at least certain of said nanoparticles have a diameter of up to about 500 nm.

54. The composite of claim 53, said nanoparticles characterized by the property of altering the polarization of incident electromagnetic radiation upon reflection or scattering of the electromagnetic radiation.